

5. Implementation Toolkit

Introduction

The purpose of this chapter is to provide those who wish to bring a regional green infrastructure network from a “hubs and corridors” map to reality on the ground – and to maintain or manage it in healthy condition – with the wherewithal to do so. The natural systems that comprise the GI network exist and function on an interconnected, regional basis, without regard for jurisdictional boundaries or property lines. Thus, identification of the GI network is done at the landscape or regional level, as we have done with the Linking Lands and Communities project. The initiative to seek out tracts that will help to implement the GI network can come from the landscape level or the local level. However, implementation of the GI network usually is done at the local level, at the scale of a farm, a forest tract, a subdivision, or even an individual parcel – and often is done opportunistically and piecemeal, “one tract at a time.”

The regional and interconnected nature of green infrastructure resources makes their long-term vitality dependent upon choices made at the regional, local and personal levels by a host of actors, including local governments (representing communities), landowners and developers. Let’s talk about how this gets done. Not surprisingly, people – individually and collectively as businesses, organizations or communities) are the actors in this drama. These **actors** (land owners, land managers, developers, communities) are the ones who determine what happens on the land (conservation, restoration, development, management). These actors are motivated by certain **drivers** or **values** (financial return on investment, water supply, food or fiber production, populations of wildlife for hunting and fishing, wilderness, etc.). They often take advantage of **opportunities** (economics, turnover of land in a family, a need to trade one piece of land for another, etc.) in setting objectives for their actions. The actors also must work within certain **guidelines** or **restrictions** imposed by local, state or federal laws, ordinances, or by voluntary guidelines and “best practices.” The actors have available to them a suite of **resources**, such as the Linking Lands maps, county and municipal land use plans, development design standards, financial capital, financial incentives, landscape design professionals, land managers, land trusts, and government helpers such as the Cooperative Extension Service, NC Division of Forestry, and the USDA Natural Resources Conservation Service.

Here is a hypothetical example that brings the above abstractions down to earth.

Our hypothetical actor is a conservation developer. She is motivated first and foremost by high Return On Investment (ROI), but also places a high value on ecological protection. She wants her residential developments to follow low impact development guidelines, and would like them to be aligned with the regional GI network, or at least not interfere with it. Financing is available and interest rates are low, and an opportunity presents itself to buy a large tract of land for a residential development. The county is zoned, has a subdivision ordinance, and administers its own erosion control program – all of which the developer must comply with.

She consults various professionals, including a landscape architect and an environmental consulting firm, both of which have access to the regional GI network maps; and takes advantage of other resources such as the county's conservation subdivision incentives program. The project results in some land placed in perpetual conservation; some developed in an environmentally sensitive manner; and the remaining acreage slated for a 10-year ecological restoration project to be carried out by the residents. The conservation and restoration portions of the tract are intentionally aligned with and contribute to a regional GI corridor for wildlife habitat and biodiversity. The homeowner covenants and conservation easement specify that the homeowners association will employ a set of land and water management practices for the entire tract that will support the GI goals of the developer.

This imaginary case study unintentionally involves all four categories of "actors" -- land owners, land managers, developers, and communities. In this case, the land owner and developer are the same person, until parcel by parcel, part of the tract is sold to individual homeowners. The new owners act collectively as a community, and their homeowners association becomes a land manager.

Ultimately, a regional GI network becomes a reality through the aggregation of many individual projects such as our hypothetical example. In addition to these local projects, there is a need for coordination of individual projects so that they link to each other and so that they contribute to the regional GI network design. This regional coordination role can be carried out by a regional organization like a council of governments or a regional land trust coalition. However, the beauty of having the Linking Lands models and tools widely available is that **anyone using the tools can see the big picture and do their part toward the regional coordination role.** The regional coordination role also includes looking to align and link the region's GI network with adjacent, existing or emerging GI networks in other regions or states.

This leads to an important point worth repeating: **widespread availability of the Linking Lands models means that regional organizations can zoom in on local opportunities to build the GI network; and local landowners, local governments, developers and land managers can see how their opportunities and actions can fit into the big picture.**

"Implementation" Defined

The above discussion of how GI networks get protected and built puts us in a position to define what this chapter is all about – **Implementation.** We will define "Implementation" of a GI network as **a series of resource planning, conservation, restoration and development actions that serve to bring an identified (mapped) GI network of hubs and corridors into reality on the ground, and to maintain or manage it sustainably.** An important thing about this definition that we learned from the Linking Lands and Communities project is that the three "on the ground" categories of implementation actions above (conservation, restoration and development) involve **land and water management practices.** Whereas we may be tempted to think of a GI network as a series of hubs and corridors that get protected by conservation easements, fee simple purchases, conservation subdivision designs, etc. – ultimately it is the

practices carried out on these lands to minimize degradation, maintain the current level of ecosystem functioning, or improve/restore it that determine whether it becomes and remains a viable, functioning part of the regional GI network. It is important to note that doing nothing and letting nature take its course is among the choices of practices. This is what land managers do in wilderness areas, for example.

The subdivision designs, conservation easements and other land and water management arrangements mentioned above are merely part of the legal and administrative structure for ensuring that beneficial practices take place over time. It is theoretically possible to “implement” an entire regional GI network by getting all of the controlling parties of all the identified hubs and corridors in the network voluntarily to conduct certain practices on their lands, without signing a single legal document or exchanging any money. Although this may be unrealistic in actual practice, **it emphasizes the central role of land and water management practices in GI network implementation.**

It will be helpful to further define the five categories of implementation actions listed above: resource planning, conservation, restoration, development and maintenance/management. The first of these, **resource planning**, is the common theme that unites all the strategies identified in this chapter. Ideally, green infrastructure is incorporated into all levels of planning and decision-making. At the regional level, governments can work together to coordinate their policies for the stewardship of resources that straddle jurisdictional boundaries. For **local governments**, green infrastructure plans are a central element of land use planning which, in turn, is the basis for formulating policies and incentives that conserve and restore natural resources. With a comprehensive view of green infrastructure inventories, local governments can make informed choices about the suitability of land for different uses. Likewise, information about the value and location of green infrastructure guides individual **landowners** as they plan for the use and restoration of land under their care. Finally, green infrastructure inventories are the touchstone for well-designed **developments** that incorporate into their design the natural features that serve homebuyers and the communities they live in. At their best, these plans tie to each other, with regional plans informing local policies and local policies fostering decisions by individual landowners and developers that conserve and restore green infrastructure for the benefit of all.

Resource planning for green infrastructure, in turn, lays the groundwork for governments, landowners and developers to implement the **conservation, restoration, development, and management activities** that turn good plans into positive results. **Conservation** strategies recognize that some green infrastructure resources are too important to lose. By placing those resources into permanent protection or limiting certain uses that degrade them, conservation strategies ensure that resources will continue to serve our communities in the long term. **Restoration** activities improve the ecological health of green infrastructure or repair old damage. **Development** activities ensure that our use of the land is sensitive to the importance of green infrastructure resources and that we minimize the impact of development on those resources. Done well, development can bring the financial resources to the table that are critical to implementation of parts of the GI network. As Mountain Wild¹ President Steve Schmeiser said in a recent meeting of the Linking Lands Future Development Work Group, “An enlightened developer can actually *improve* the wildlife habitat characteristics of his or her development tract.” Finally, land and water **management** activities improve or maintain the resilience of the GI network to future disturbances such as fire, invasive species and climate change – and they also help to retain the value of conservation, restoration or development actions.

To summarize: **resource planning** is a step conducted by all types of “actors” at all levels, to plan for their goals of conservation, restoration, development and management. The Linking Lands tools are resource planning tools that empower all actors to coordinate their resource planning with one another. All applications of the Linking Lands tools ultimately are for the purpose of implementing the GI network.

¹ Mountain Wild! Is a chapter of the NC Wildlife Federation.

Using the Linking Lands and Resource Planning Tools:

- A county uses the tools in its Comprehensive Plan update and/or its Development Review process
- Developer uses the tools to ID best orientation for a planned subdivision
- NCDOT and MPO use the tools to mitigate negative impacts of intersection improvements upon wildlife crossings
- NCDOT and MPO use the tools to help identify best new alignment for a road
- NC Wildlife Federation works with a developer to facilitate a Wildlife-Friendly Development Certification
- A greenways commission uses the tools to plan a regional greenway (including to avoid making the greenway a pathway for invasive species to reach Priority Ecological Systems)
- A land trust uses the tools to prioritize key agricultural lands for protection
- The USFS uses the tools to make resource management decisions
- The NCWRC uses the tools to prioritize land management practices for a newly-acquired gamelands tract
- A developer uses the tools to gain regional credit for LEED certification of his/her project

This chapter focuses upon how to assess *your* **implementation drivers, objectives, opportunities and barriers**. Then it points you to the **resources** – including the Linking Lands tools -- needed to make implementation successful.

Implementation Process Summary

The above discussion suggests that we might organize this Implementation chapter around the five categories of implementation actions: resource planning, conservation, restoration, development and management. However, we are going to take a broader “scenario” or “process” approach to implementation. This involves creating a “process map” of any particular implementation scenario as an aide to figuring out what resources are needed, and where and how they best can be brought to bear.

With this in mind, here is our implementation process:

1. **Identify the objective at hand.** Your objective will be one or more resource planning, conservation, restoration, development and/or management actions that serve to bring part of an identified (mapped) GI network of hubs and corridors into reality on the ground, and/or to maintain the network. Objectives may be the result of **proactive planning** – for example, searching for a way to relieve a “pinch point” or bottleneck in a wildlife corridor. Or objectives may be opportunistic. For example, it may be that you have become aware of a tract of land coming up for sale – or a proposed new subdivision that has entered the county land use permit process. Or it might be a grant opportunity that could enable funding for a conservation easement or a fee simple purchase.
2. **Map out the drivers (values), restrictions & guidelines, and initial resources** related to the objective at hand.
 - a. **Drivers or values** – it is important to try to understand the personal and organizational values of the actors involved in your opportunity, because their values will influence their stance on the GI network and their inclination to help bring the opportunity into reality. It will also help you to identify what kinds of barriers these actors might perceive in the opportunity, and how you can help them to find resources to overcome their barriers. For example, a wealthy landowner putting a tract of land up for sale may have hit financial hard times and thus may value an income stream from the sale. Her income tax situation may be such that she values making part of the transaction a donation for tax writeoff purposes. Knowing that a potential buyer exists who values farmland preservation might lead you to use the LLC tools to see what farmland values the tract represents. Similarly, knowing that the county government values agricultural land preservation would be helpful. Knowing that a grantor exists that values water supply protection might lead you to use the LLC water quality model to assess that aspect of the subject tract for a potential grant application.

- b. **Restrictions and guidelines** – any opportunity to implement part of the regional GI network will be subject to restrictions and guidelines of one sort or another. These could include the legal framework for selling a tract of land or selling a conservation easement; the approval process for getting a permit to develop a subdivision; or local design guidelines for conservation subdivisions. Restrictions and guidelines may affect the feasibility or cost of a project, and may make it easier or more difficult for the objective at hand to contribute to the regional GI network.
- c. **Initial resources** – these are the immediately obvious resources that are available, and that will help you to accomplish your objectives. Even some of what we have classified as “restrictions and guidelines” could be viewed as resources (e.g., county incentives for conservation subdivisions).

In our hypothetical example above, these first two steps might look something like this:

1. **Opportunity** – a large tract suitable for residential development is for sale; financing is available and interest rates are low.
2. **Objective** – to purchase the tract and design and develop a conservation subdivision.
 - a. **Value drivers** – the conservation developer’s primary values are high Return on Investment; and ecological protection. The county values agricultural land preservation. The local eco-realtor has an established base of clientele interested in investing in conservation-oriented subdivisions.
 - b. **Restrictions & guidelines** – county zoning ordinance, subdivision regulations, erosion control program, water & sewer extension policy. The county’s subdivision regulations provide incentives for conservation subdivisions. LEED has adopted the Linking Lands models and gives “regional points” toward LEED certification based upon how many LLC resource hubs (water quality, agriculture, wildlife habitat & biodiversity) a project protects.
 - c. **Initial resources** – a landscape architect and environmental consulting firm that specializes in conservation-friendly projects; existence of an identified regional GI network (Linking Lands); and the county’s conservation subdivision incentives program. Also, the county office of the USDA Natural Resources Conservation Service (NRCS) is known to be active in making landowner cost share funds available for best land and water management practices.
3. **Ask some key questions about the situation. Examples below relate to our hypothetical opportunity for a conservation subdivision project:**
 - a. *Are there any barriers to creating a win-win project?* For example:
 1. Barriers related to the **opportunity or objective** itself? (e.g., sales price too high; or very short timeframe to put a deal together)

2. Barriers related to conflicting **value drivers** (e.g., the surrounding community does not want the project; or interests in the community have conservation values for the tract different than yours)
 3. Barriers related to **restrictions and guidelines** (e.g., the project is just outside the geographic boundaries of the area to be served by water and sewer extensions; or the conservation portion of the project will only protect one Linking Lands resource hub type, say Agriculture, leading to a low number of regional LEED points)
 4. Barriers related to **resources** (i.e., a needed resource has been identified but is not readily available. For example, the conservation developer wants to offer green mortgage financing for buyers who build Healthy Built Homes, but no such program is available among lenders in the area)
- b. *What **additional resources** might be brought to the table to overcome the barriers?*
Examples might be:
1. Resource planning tools (e.g., the Linking Lands resource assessments, hubs maps, GI Network map, and other GIS tools)
 2. Organizational resources (e.g., creative collaborations, partnerships, business models)
 3. Technical assistance (e.g., additional or specialized scientific, ecological or technical help on best land and water management practices; grant writing assistance; legal assistance, such as with conservation easements; or guidance through a public process such as a county planning board hearing)
 4. Funding or other financial assistance (e.g., structuring a conservation deal; financing; funding/grants)
 5. Legislative resources (e.g., create a local ordinance enabling a Transfer of Development Rights program; state enabling legislation to fund the Farmland Trust Fund)
 6. On-the-ground resources (e.g., land management skills or direct labor to conduct Best Management Practices)
- c. *Where can these resources be found?* The above comprise some types of resources you might need. An appendix to this chapter contains a list of resources we have discovered during the Linking Lands project. These links show how actual GI network implementation “actors” in many localities have found and applied similar resources.

Comprehensive Implementation Examples

Implementation objectives for pieces of the regional GI network can arise in numerous ways. The following examples illustrate both proactive and opportunistic objectives.

Comprehensive Example 1

Objective: Changing land and water management practices

A regional planning commission teams up with county NRCS, SWCD and Cooperative Extension offices to target landowners of tracts in WHB hubs and corridors for a voluntary “Best Land & Water Management Practices” (BMPs) training and incentives project. The practices targeted will be a specific suite of BMPs designed to make our ecosystems more resilient to future disturbances from fire, flooding, erosion, invasive species and climate change.

This is an example of a **proactive** objective – targeting specific tracts of land critical to the GI Network for improved management practices. This objective relates to the fifth type of implementation action, **management** – although it could be argued that that a certain amount of ecosystem **restoration** may take place on the targeted lands as a result of the BMPs implemented.

Opportunity (not applicable -- this is a proactive objective, not one driven by an opportunity at hand)

Value drivers – The organizations sponsoring the training and incentives value utilizing sound management practices, that will make the ecosystems on the targeted lands more resilient and sustainable. Each land owner, however, may have slightly different values driving their actions related to how they choose to use and manage their land.

Restrictions & guidelines – A variety of regulations and guidelines may apply based on the type of management activities chosen and the geographic location of the land. Many cities and counties have regulations governing land use, land disturbing activities, stormwater management and development in floodplains. In some counties the state regulates land disturbing activities and erosion control measures. Land owners should check with the local government planning/permitting office to find out what the specific rules apply to their property and what guidelines exist that may be helpful.

Initial resources – Staff at the county planning department, Extension office, NRCS and SWCD; county’s farmland preservation plan (if it exists); Linking Lands maps and data; Low Impact Development (LID) resources.

Key questions & answers – Are there any grants available to help pay for utilizing some new management practices? What are the costs associated with the various recommended practices? Are there incentives for changing land management practices or using recommended ones?

Additional resources needed – *Mountain Landscapes Initiative Toolbox*, *Green Growth Toolbox* for information and BMPs for land and water management, conservation-based design, and more.

Where to find them – See Implementation Resources list at the end of this chapter.

Comprehensive Example 2:

Objective: Changing control over a tract of land

This objective usually results **opportunistically**. In this hypothetical example, a landowner goes to a land trust seeking a tax-sheltered way to sell some land and simultaneously accomplish some conservation goals. The land trust checks the Linking Lands resource assessments to evaluate the value of the lands in question vis-à-vis the regional GI Network. This example primarily relates to the implementation action of **conservation**.

Opportunity – A landowner interested in conservation and reducing the taxes on his/her land, approaches a land trust for advice on ways to accomplish these goals.

Value drivers – Tax savings and conservation of land.

Restrictions & guidelines – IRS rules related to allowable land use activities for conservation easements; county or city land use and development regulations; state law governing tax considerations for conservation easements.

Initial resources – Linking Lands resources assessments and GI Network maps; GIS data layers showing specific features of interest on the property (e.g., streams, topography, endangered species, etc.); county tax parcel map; county/city zoning map and related regulations;

Key questions & answers --

Additional resources needed – Landscape architect and/or land designer for professional advice and site design. *Mountain Landscapes Initiative Toolbox* and *Green Growth Toolbox* for information and strategies on conservation-based design, maintaining wildlife habitat, steep slope development and conservation strategies.

Where to find them – See Implementation Resources list at the end of this chapter.

Comprehensive Example 3:

Objective: Incorporating the Linking Lands resource assessments and GI Network into an update of a local government's comprehensive plan

In this example, a county in the Land-of-Sky Region is preparing to update their comprehensive (or land use/development) plan. Now that data and maps are available from the Linking Lands and Communities project, it wants to incorporate them into the planning process. This is an example of a proactive objective, with the county's desire to utilize the new data to enhance their planning process.

Opportunity (not applicable -- this is a proactive objective, not one driven by an opportunity at hand)

Value drivers – County wants to use the best available data and wants to take advantage of the scientific analysis that went into creating the LLC data and maps.

Restrictions & guidelines – State laws related to land use planning and its connection to local land use regulations; guidelines from the NC School of Government, the American Planning Association and others about comprehensive plans and plan-making.

Initial resources – Linking Lands resources assessments and GI Network maps; individual GIS data layers showing specific features of interest; technical documentation of the GIS data and modeling processes; other county and state map layers relevant to the comprehensive plan.

Key questions & answers – What assumptions and values went into the resource assessments and GI network?

Additional resources needed – Training on the datasets and methodology utilized in the LLC assessments and GI network; GIS modeling assistance IF the county chooses to change the rankings on any of the assessments.

Where to find them – See Implementation Resources list at the end of this chapter.

Managing the Green Infrastructure Network for Future Disturbances and Climate Change

The Linking Lands Leadership Group recognized that the ability of ecosystems to function in a healthy manner and to provide services to human communities in the region could be weakened by future disturbances such as fire, insects, diseases, invasive plants and severe weather. All of these types of disturbances occur in the region now, and the frequency and intensity of many of them likely will be affected by climate change.

The U.S. Global Change Research Program offers the following assessment of climate trends for the Southeastern US:

“The annual average temperature in the Southeast has risen 2°F since 1970, with the greatest seasonal increase in the winter months. There has been a 30 percent increase in fall precipitation over most of the region but a decrease in fall precipitation in South Florida. Summer precipitation has decreased over almost the entire region. The percentage of the Southeast in moderate to severe drought increased over the past three decades. There has been an increase in heavy downpours. The power of Atlantic hurricanes has increased since 1970, associated with an increase in sea surface temperature.

Continued warming is projected, with the greatest temperature increases in summer. The number of very hot days is projected to rise at a faster rate than average temperatures. Average annual temperatures are projected to rise 4.5°F under a lower emissions scenario and 9°F under a higher emissions scenario with a 10.5°F increase in summer and a much higher heat index. Sea-level rise is projected to accelerate, increasing coastal inundation and shoreline retreat. The intensity of hurricanes is likely to increase, with higher wind speeds, rainfall intensity, and storm surge height and strength.”

Key issues identified for the Southeast include:

- “Projected increases in air and water temperatures will cause heat-related stresses for people, plants, and animals.
- Decreased water availability is very likely to affect the region’s economy as well as its natural systems.
- Sea-level rise and the likely increase in hurricane intensity and associated storm surge will be among the most serious consequences of climate change.
- Ecological thresholds are likely to be crossed throughout the region, causing major disruptions to ecosystems and to the benefits they provide to people.
- Quality of life will be affected by increasing heat stress, water scarcity, severe weather events, and reduced availability of insurance for at-risk properties.”



Southeast

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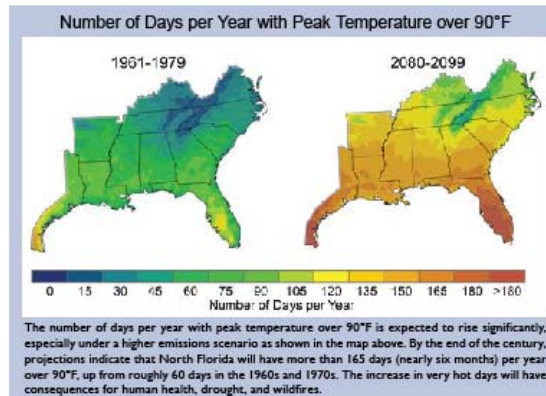
A note on the emissions scenarios

None of the emissions scenarios used in this report include any policies specifically designed to address climate change. All, including the lower emissions scenario, lead to increases in heat-trapping gas emissions for at least the next few decades, though at different rates.

Key Issues

Projected increases in air and water temperatures will cause heat-related stresses for people, plants, and animals.

Effects of increased heat include more heat-related illness; declines in forest growth and agricultural crop production due to the combined effects of heat stress and declining soil moisture; declines in cattle production; increased buckling of pavement and railways; and reduced oxygen levels in streams and lakes, leading to fish kills and declines in aquatic species diversity.



The *Western North Carolina Report Card on Forest Sustainability* published in 2010 by the USDA Forest Service Southern Research Station has the following to say about future disturbances:

“The forests of Western North Carolina are threatened by a wide variety of environmental stressors and disturbances such as insects, disease, invasive species, drought, fire, hurricanes, tornadoes, and ice storms. A **stressor** is any kind of event or action which, at certain levels, causes stress to organisms; for example, a period of drought. A **disturbance** is a relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment; for example, a wildfire.

Organisms may adapt to a level of disturbance, but when another threshold is exceeded **degradation** occurs. Degradation is the destruction of complex natural environments.

When one ecosystem is under attack as a result of natural or man-made events, it is extremely difficult to calculate the ripple effects throughout the natural system. Sometimes stress, disturbance, and degradation occur individually, but more often they come in combination. The resulting effects can be severe and cause significant, lasting impact on ecological and socioeconomic values.

To effectively sustain the forests of North Carolina, there is a need to integrate how we deal with interacting, multiple threats so that land managers may anticipate disturbances and act to prevent or lessen the effects, or restore either the structure or the function of affected ecosystems.” (*Report Card*, p. 57) (**bold** font added for emphasis)

According to the *Report Card*, climate change is one of several ecosystem threats. The full list of threats includes:

- Insects and diseases
- Invasive plants (deemed second only to habitat destruction as a threat to our forests)
- Forest fire
- Severe weather, including:
 - Hard freezes
 - Blizzards
 - Ice storms
 - Tropical storms
 - Hurricanes
 - Tornadoes
 - Heavy rains
 - Drought
 - Flooding
- Climate change
(*Report Card*, pp. 58-68)

The Report Card goes on to discuss some of the likely key impacts of the above threats:

“Forests are acclimated to the climate zones in which they are found. Warming temperatures due to climate change will shift suitable conditions. With changing temperatures and precipitation, dominating forest types are likely to change. Warmer temperatures will shift suitable habitat for forests higher in altitude.

Drought

Decreased precipitation or increased temperature will lead to increased drought. Drought occurs in all forest types, and the general response of forests to drought is to reduce vegetation growth. Under severe drought, forests reduce vegetation growth and plants die. When

drought occurs over multiple growing seasons, increased susceptibility to insects or pathogens is possible.

Fire

The frequency, size, and intensity of fires depend on climate as well as forest structure and composition. While fire is a natural occurrence in many forest types, increased frequency and severity of natural fires would greatly impact the forest. Decreased precipitation from climate change would increase fire risk in areas that become drier, and these changes could compound existing fire risks. While fire may be detrimental to some forest types, the vulnerability of the forest will depend on its resiliency and ability to adapt.

Insect infestations

Changes in temperature and precipitation also affect insect and pathogen survival, reproduction, and distribution. These changes can have a range of effects on forests and lead to increased tree mortality rates. The loss of certain tree species to disease or infestation can significantly reduce biodiversity and wildlife habitat.” (*Report Card*, p. 80)

Resiliency and Forest Management

The *Report Card* defines “**resilient**” forests as those that rebound after one or more of the above disturbances. It points out that forests are valuable in **adaptation** to climate change because they provide reservoirs for high quality water, and refuges for biodiversity. (*Report Card*, p. 68). (**bold** font added for emphasis)

The *Report Card* concludes, “Because the forests of Western North Carolina may experience great change, how we use forest resources may also change. The ability to manage for disturbances affected by climate change varies greatly; therefore, strategies for coping with impacts from climate change in forests will vary regionally and by management area. Integrating information about climate change and its potential impacts at a regional scale can help us answer the following questions about forest sustainability:

- *How do forest disturbances interact with climate change?*
- *How should forests be monitored to inform decisions?*
- *What information is needed to understand the response of a forest to changing conditions?*
- *What changes could forest managers make to reduce negative impacts of climate change?* (*Report Card*, p. 80)

By way of solutions, the *Report Card* mentions existing approaches for invasive species disturbances (chemical or manual treatment); and for forest fire disturbances (conduct prescribed burns; let naturally-occurring fires burn; and manage fire intensity as they burn in order to increase benefits and reduce damage to forest ecosystems). No solutions are suggested for insects and disease disturbances or for severe weather disturbances. Regarding

climate change, the *Report Card* suggests that “By looking at historical climate data and prevalent climate trends, we can assess what changes Western North Carolina might expect, and begin to understand how to prepare for possible changes.” (*Report Card*, pp. 58-68).

The Linking Lands Leadership Group agreed that resilience is the key characteristic of ecosystems that we need to enhance in order to protect the continued robust ecological functioning of the region’s ecosystems in the face of future disturbances AND to minimize the damage to human communities in the face of those disturbances. Damage minimization is an ecosystem service provided by our green infrastructure that will become increasingly valuable as our climate changes.

By virtue of natural selection, the ecosystems in our region are here because they have adaptations that make them resilient to natural variations in weather, severe storms, etc. Additionally, several factors built into the Linking Lands GI Network design tend to favor ecosystem resilience. First, the choice of 100 acres as a minimum hub size means that hubs provide large acreages of interior forest area. Second, corridors comprised of lands with high ecological value allow for movement of animal and plant species when conditions change. Third, because the Linking Lands corridors generally do not pass through the heart of urban areas, they minimize the spread of invasive species outward from urban areas, and minimize the migration of unwanted wild animals into urban areas. Finally, the GI Network design calls for the protection of the types of forest cover and soils that provide the best natural flood damage protection for our human communities.

The Leadership Group and the Future Disturbances Work Group that advised it on these issues discussed two alternative approaches to maximizing the future resilience of our ecosystems:

1. Try to revise the network design to better withstand the highest-impact future disturbances; and
2. Encouraging land & water management practices that will improve ecosystem resilience in the face of likely future disturbances.

The ecologists on the work group felt the first approach to be too complex, difficult and time consuming to accomplish within the remaining Linking Lands project time and resources. They preferred the second approach, which calls for identification of a special set of “best practices for resilience” tied to the objectives of each conservation, restoration, development or management project.

Best Practices for Resilience

One way to approach the identification of “best practices for resilience” is to tie them to the three Linking Lands resource assessments (Wildlife Habitat & Biodiversity, Water Quality, and Agriculture). The primary questions these assessments were designed to answer were:

- *Which lands are valuable for wildlife habitat and biodiversity?*

- Which lands are valuable for producing clean water?
- Which lands are valuable for farming and forestry?

The parallel process for identifying best practices for resilience would be to add a set of “best practices for resilience” questions to the **implementation process map** developed above in this chapter. Here is the process map so far, as discussed above:

Opportunity –
Value drivers –
Restrictions & guidelines –
Initial resources –
Key questions & answers --
Additional resources needed –
Where to find them –

...to which we now add:

Best practices for resilience --

To ensure that the practices selected support the objectives of the specific conservation, restoration, development or management project, we ask the following questions:

1. What are the specific **objectives** of this project related to:
 - a. Wildlife habitat and biodiversity?
 - b. Water quality?
 - c. Farming?
 - d. Forestry?
2. Based upon www.globalchange.org, the *Report Card*, other sources, and consultation with technical assistance providers -- what are the likely **impacts** of future disturbances on our ability to accomplish these objectives?
 - a. Likely impacts upon **ecosystem health and function**?
 - b. Likely impacts upon **ecosystem services to human communities**?
3. What land and water management practices are most likely to **increase the resilience** of these resources and **decrease the likelihood of their degradation**? (per the above *Report Card* definitions of these terms)
4. What are the possible unintended consequences of implementing these practices? (examples: a practice that makes the ecosystem more resilient to wildlife habitat impacts but less resilient to predicted farming impacts; a practice that improves farming resilience at the expense of water quality resilience)

Implementation Resources



A wide variety of resources exist to aid in the implementation of the green infrastructure network. Included here are some resources that are found or were developed in this region as well as resources from other places. This is only a partial list of all the possible resources.


Linking Lands and Communities Data, Maps, Information

Maps and documentation explaining the project, maps, methodology and more are available on the Linking Lands and Communities website (www.linkinglands.org). A complete set of maps and “fact sheets” are available for printing or downloading. GIS datasets are available by request from Land-of-Sky Regional Council. In order to receive the GIS datasets, recipients will be asked to attend a training session that will explain the maps and data in more detail.

State Government Resources

There are many resources that may be useful in implementation in a number of state agencies – Department of Environment and Natural Resources (DENR), Division of Forest Resources, Division of Community Assistance (DCA), Department of Agriculture, Wildlife Resources Commission (WRC), NC Geological Survey, and others – depending on what type of implementation activities will be undertaken. Listed below are just a couple of these resources.

Agency / Organization Name and Link	Description of Resources
Conservation Planning Tool	Part of the One NC Naturally Program of NC DENR, the Conservation Planning Tool is composed of multiple natural and cultural resource assessment layers that can be used independently and together. These overlap somewhat with data layers and assessments done in the Linking Lands and Communities project.
One North Carolina Naturally 	Provides science information and incentives to inform and support conservation actions of North Carolina's conservation agencies and organizations.
North Carolina Wildlife Resources Commission 	The NC Wildlife Resources Commission (WRC) is dedicated to the wise-use, conservation, and management of the state's fish and wildlife resources. WRC policies and programs are based on scientifically sound resource management, assessment and

		monitoring, applied research, and public input.
NC Division of Community Assistance, Asheville Regional Office	 NORTH CAROLINA <i>the state of minds</i>	The Division of Community Assistance (DCA) provides planning and community development technical assistance and services to help communities reach their goals.

County Planning and Permitting Offices




County planning and permitting staff can provide useful information and advice about the planning and permitting processes, local plans and regulations, local data and technical resources, etc. Counties also have parcel and other data available on their websites. Below are websites and phone numbers for these offices in the four counties of the Land-of-Sky Region.

County	Website address	Phone
Buncombe	Planning: http://www.buncombecounty.org/governing/depts/Planning/ Permitting and Inspections: http://www.buncombecounty.org/governing/depts/Permits/	250-4830 250-5360
Henderson	Planning: http://www.hendersoncountync.org/depts/planning.html Permit Center: http://www.hendersoncountync.org/depts/permitcenter.html	697-4819 697-4830
Madison	Inspections, Planning and Zoning: http://www.madisoncountync.org/zoning.php	649-3766
Transylvania	Planning and Zoning: http://econdev.transylvaniacounty.org/index.asp Building Permitting and Enforcement: http://www.transylvaniacounty.org/permitting.htm	884-3205 884-3209

Local, Regional and Statewide Land Trusts

Land trusts are valuable resources for land owners interested in preserving open space, wildlife habitat, farmland, forests and other natural/cultural resources on their land. Land trust staff have expertise in preservation and conservation issues and can assist land owners in creating a conservation easement for their land.

Land Trust Name and Link	Geographic Area
Blue Ridge Forever 	Coalition of thirteen local, state and national conservation organizations covering western North Carolina

Land Trust Name and Link	Geographic Area
Carolina Mountain Lands Conservancy 	Henderson and Transylvania counties
Conservation Trust for North Carolina 	North Carolina
Southern Appalachian Highlands Conservancy 	The mountains of North Carolina and eastern Tennessee

Studies, Toolkits, Best Management Practices – Internet Resources

Below are listed some resources available on the internet that may be useful for implementation. A number of the resources are collections of tools for managing growth and maintaining a balance of natural and cultural resources and development.

Carolina-Charlotte-CONNECT

http://www.cogsconnect.org/ccog/index.php?option=com_content&task=view&id=60&Itemid=113 (the “Resources” web page)

Greater Charlotte Region’s Visioning Project. It is a nationally-unique approach to finding ways to preserve what is valued and plan for growth as the region doubles in population.

Conservation Design Scorecard

<http://www.1000fom.org/sites/default/files/ConservationDesignScorecard1000FOM.pdf>

Developed by 1000 Friends of Wisconsin, this document explains Conservation-based Design and contains a scorecard to measure how well a development project meets the conservation design goals.

ConserveMyLand.org was designed as a pilot project to help urban fringe landowners just outside Nashville that are in the path of rapid development. While it was designed primarily for the Williamson County area, it is being used throughout the state, with plans to expand it to other counties and watersheds. The site provides assistance on farmland preservation strategies and best management practices through video case studies, tutorials, fact sheets and assistance from project partners.

Environmental Corridor Management, National Cooperative Highway Research Program, Transportation Research Board, NCHRP Project 25-25/63 (June 2010)

(http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25%2863%29_FR.pdf)

This report presents a framework for conducting and documenting environmental management activities by transportation corridor, focusing on the core maintenance

practices of roadside management and the primary areas of attention for environmental performance measurement identified by AASHTO and FHWA: resource use and recycling; water quality; roadside environmental management; and energy. Through presentation of practices for extending, measuring, and prioritizing environmental stewardship efforts in each of these core areas, this document outlines a framework for DOTs to manage transportation corridors for environmental benefit in an approachable, feasible, and relatively cost-effective way in today's tight budgetary times.

Envision Central Texas – Quality Growth Toolbox

Envision Central Texas, 2007. (<http://soa.utexas.edu/csd/research/quality-growth>).

The Quality Growth Toolbox is an online collection of resources, models and best practices designed to assist communities as they plan for growth.

Envision Utah – Quality Growth Strategy

(<http://www.envisionutah.org/qualitygrowthstrategy.phtml>)

The Envision Utah initiative identified seven primary goals that need to be addressed in order to protect the environment and maintain the economic vitality and quality of life as the area accommodates anticipated growth. The Quality Growth Strategy outlines a set of strategies to achieve these goals.

Farm Promotion and Support: Ideas and Tools for Economic Development and Tourism Development Authorities. www.AppalachianGrown.org

Appalachian Sustainable Agriculture Project (ASAP), 2009.

Green Growth Toolbox

(www.ncwildlife.org/greengrowth/index.htm). NC Wildlife Resources Commission, 2009.

The Green Growth Toolbox provides useful information to communities about how to promote and achieve nature-friendly growth and development. It is designed to help communities plan for growth in a way that conserves natural assets, including important habitats – fish, wildlife, plants, streams, forests, fields, and wetlands.

Green Infrastructure Municipal Handbook.

EPA, National Pollution Discharge Elimination System (NPDES) program.

<http://cfpub.epa.gov/npdes/greeninfrastructure/munichandbook.cfm>

The Municipal Handbook is a series of documents to help local officials implement green infrastructure in their communities. Handbook topics cover issues such as financing, operation and maintenance, incentives, designs, codes & ordinances, and a variety of other subjects. The handbook documents are intended to serve as "how to" manuals on these topics, written primarily from the standpoint of municipal implementation.

Mountain Landscapes Initiative Toolbox (www.mountainlandscapesnc.org)

The Southwestern Planning and Economic Development Commission, the Community Foundation of Western North Carolina and The Lawrence Group Architects of North Carolina, Inc., 2008.

A comprehensive collection of planning, preservation and development tools developed by people and organizations in western North Carolina for the communities in WNC. The toolbox covers a wide range of topics and provides numerous illustrations, links to resources and case studies.

Mountain Ridge and Steep Slope Protection Strategies report

(http://www.landofsky.org/planning/p_mountain_ridge_steep_slope.htm)

Mountain Ridge and Steep Slope Protection Advisory Committee, 2008.

This report provides a comprehensive examination of issues related to steep slope and ridgetop development and suggests a variety of policies, practices, incentives and regulations to address the issues. It contains a wealth of links to resources related to ridge and steep slope development.

Quality Growth Strategies in the Southeast

(<http://www.southeastwaterforum.org/news/newsletters.asp>)

Southeast Watershed Forum, April 2009

This publication first looks at challenges facing the Southeast as a whole and then looks at towns, villages, and neighborhood developments where on-the-ground Quality Growth strategies are being implemented successfully. Found within the report are training and on-line resources for individuals, organizations and communities.

Quality Growth Toolbox

(http://www.cumberlandregiontomorrow.org/documents/00-Entire_Book.pdf)

Cumberland Region Tomorrow, 2008/2009

This Toolbox is a collection of tools, model programs, technical support, and resources that support the implementation of quality growth principles.

Sustainable Sites Initiative Guidelines and Performance Benchmarks, (Draft) 2008

(<http://www.sustainablesites.org/report/>)

Sustainable Sites Initiative, a partnership of the American Society of Landscape Architects, the Lady Bird Johnson Wildflower Center and the United States Botanic Garden; the initiative focused on creating voluntary national guidelines and performance benchmarks for sustainable land design, construction and maintenance practices.

The Case for Sustainable Landscapes

Sustainable Sites Initiative, 2009.

(http://www.sustainablesites.org/report/The%20Case%20for%20Sustainable%20Landscapes_2009.pdf)

This handbook provides a set of arguments—economic, environmental, and social—for the adoption of sustainable land practices, additional background on the science behind these practices, and a sampling of case studies. It is a good resource on the economic benefits of ecosystem services.